PCB TMDL Monitoring of Point Source Discharges

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PCB TMDL Monitoring Guidance
TAC

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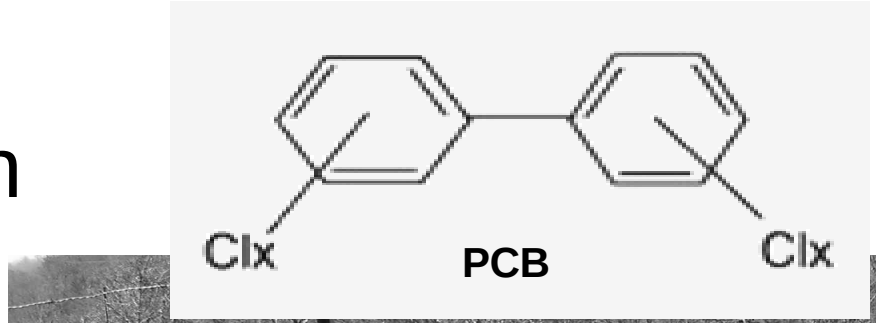
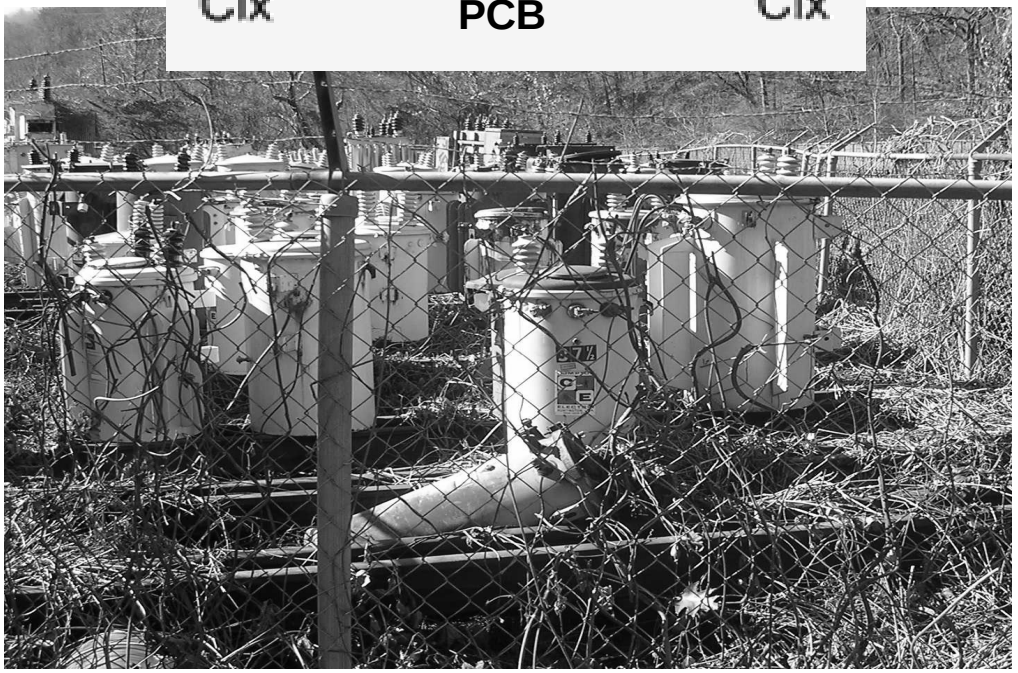
Discussion Overview

- PCB Primer
- Sample Collection Options
- PCB Analysis
- QA/QC
- Interpreting Results
  - Decision Rules
- Effluent Results





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What are PCBs?

- Biphenyl molecule with 1-10 chlorine atoms
- Homologs (grouping based on # chlorines)
- 209 distinct PCB Compounds (Congeners)
- Total PCB (tPCB) = Summation of 209 Congeners *(Basis for VA WQS)*
- Aroclors – mixture of congeners
  - Aroclor 1260 is 60% chlorine

PCBs

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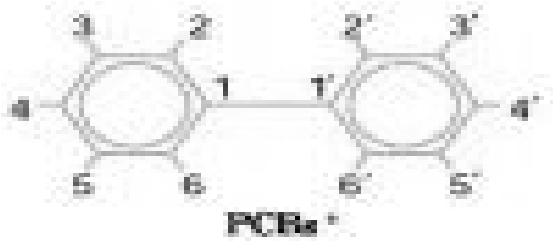
PCB Characteristics

- Most stable organic compounds known
- Very hydrophobic – attach to organic particles in soil and sediment
- Lipophilic – accumulate in the fatty tissues
- Volatilize to Atmosphere
- Listed as probable carcinogen



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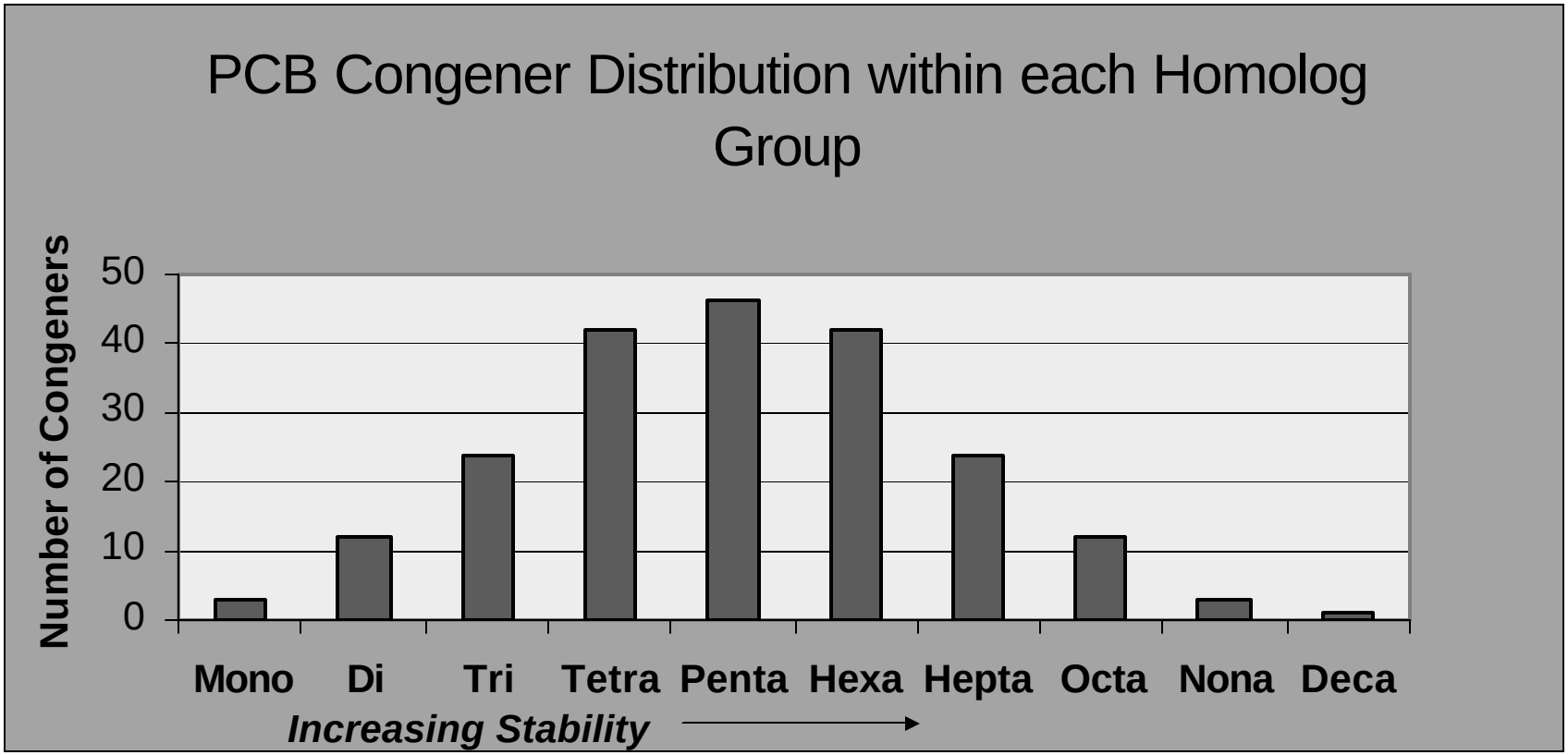
PCB Homolog Distribution



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TMDL Challenge
- PCB Impaired Waterbodies -

- TMDL Development (WLA)
- Lack PCB effluent data for loadings
  - EPA Method 608 (Permit method)
  - Deficiency requires assumptions
    - Options
      - No data = no load?
      - Use assumptions (QL, DL)

      or

      - Generate low level PCB data

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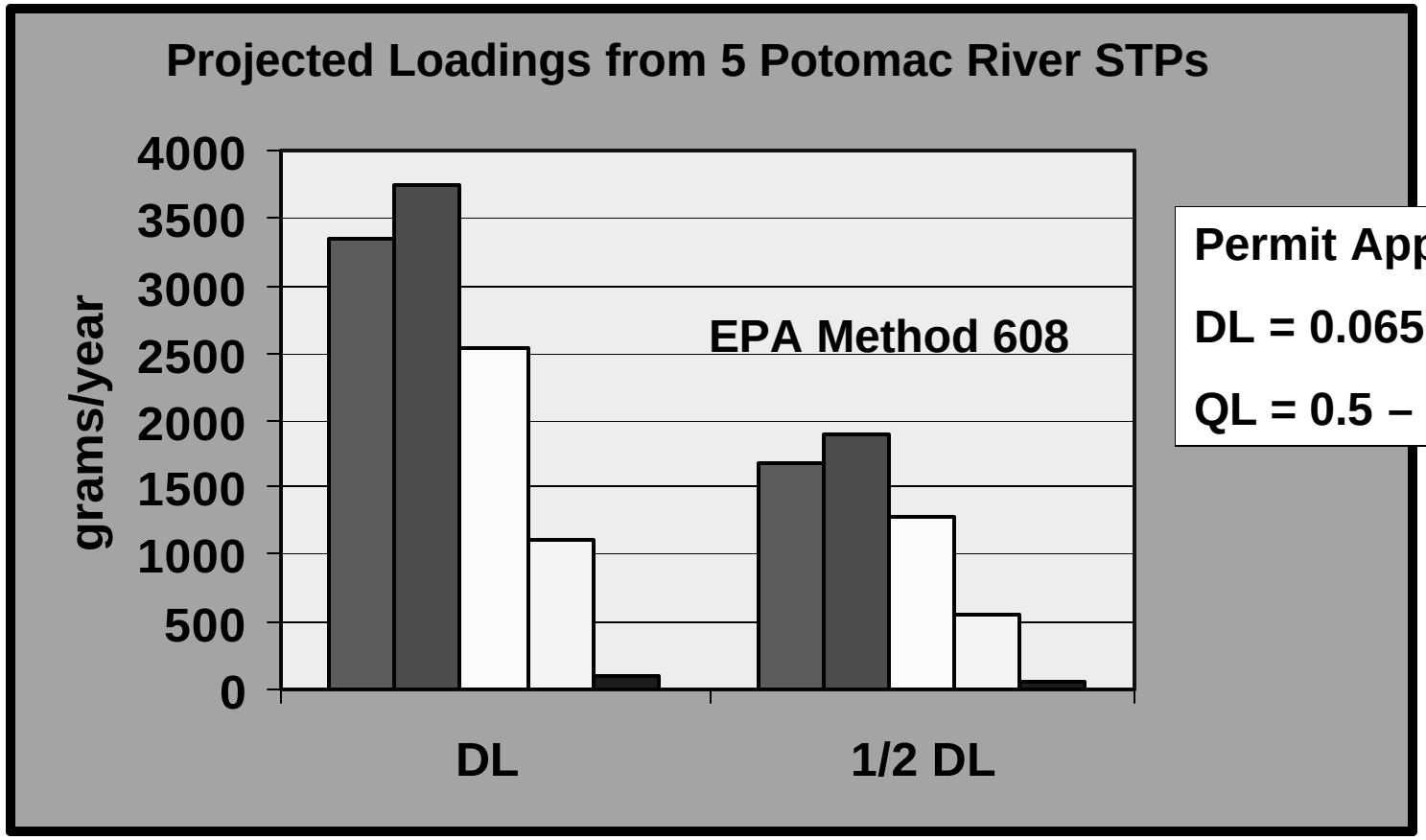
Estimate PCB Loadings



Permit Application Data

DL = 0.065 ug/L

QL = 0.5 – 50 ug/L

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Generate PCB Data for Loadings

- Preferred alternative -

- **Need:** Develop PS PCB loadings
- **Goal:** PCB Data Generation
  - Ensure quality, representative and comparable
    - e.g. Number of PCB congeners analyzed
  - Utilize appropriate sampling and analytical procedures

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PCB Effluent Sampling

- Which sampling method will yield the best data?
- For high volume discharges, will a 24h composite sample address effluent variability?
- Wet vs. Dry?

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PCB Sampling Objective

- Ensure high quality PCB data generated
  - Follow effluent sampling protocol (clean technique)
  - Low level analysis (pg/L)
  - Use same analytical method (1668A)
- Based on the Delaware River Basin (DRBC) procedures
    - http://www.state.nj.us/drbc/toxics_info.htm

PCB Sampling Objective

- Eliminate (or minimize) potential for external contamination
- Sampling options:
  - 24h Composite samples
  - Grab sample(s)
  - Semi-Permeable Membrane Device (SPMD)

Option 1

24h Composite Samples

- Traditional approach (permits)
- DRBC approach
- Used by Potomac River Point Source dischargers (TMDL)
- Clean technique
- Two (2) Liter samples

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24h composites (continued)

- Advantages
  - Hourly aliquot captures variability
- Disadvantages
  - Extensive protocol for clean-up and collection
  - Potential for equipment contamination
  - Additional cost for equipment, sampling, and analysis (rinsate blanks)

Option 2

Grab Samples

- Collect 1 or more instantaneous samples
  - Address effluent variability by collecting samples at a pre-determined frequency (e.g. 4, 6, or 8 hour intervals)
  - Composite aliquots (in laboratory) for analysis

Grab samples (continued)

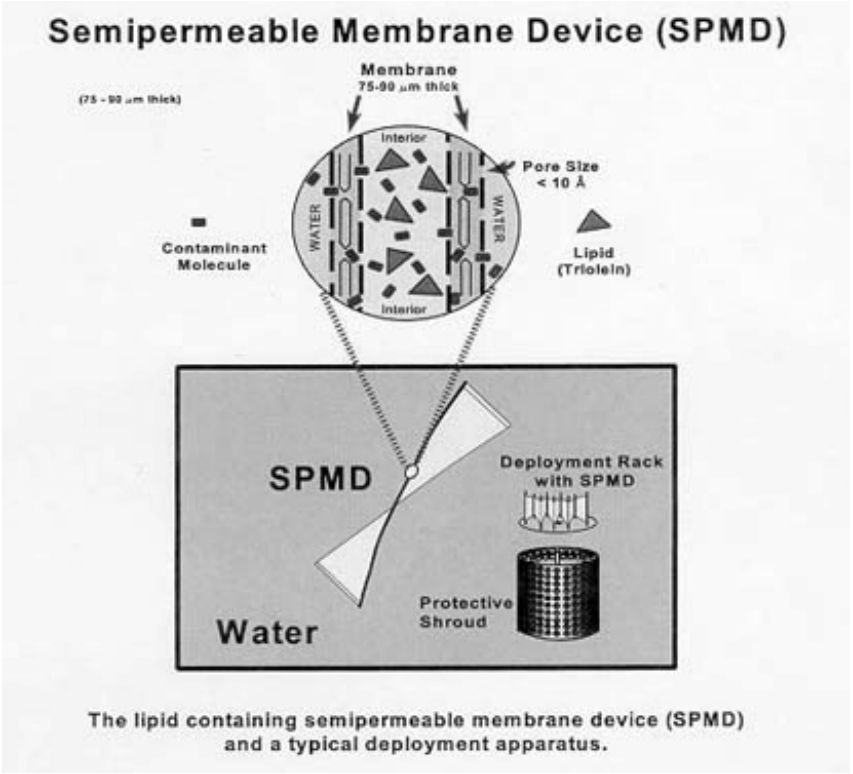
- Advantages
  - No specialized personnel/training (clean technique required for grabs)
  - Minimize equipment needs and pre sample collection clean-up
  - Reduced cost (less samples)
  - Minimize extraneous contamination
- Disadvantages
  - May miss spikes

Option 3

SPMDs

- Semi-Permeable membrane Device (SPMD)
- USGS
- Comprised of lipid material
- Sequesters dissolved (bioavailable) PCBs from effluent
- Deployed 30 days
- tPCB concentration estimated

“Virtual Fish”



The lipid containing semipermeable membrane device (SPMD) and a typical deployment apparatus.

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Building a SPMD

Semi-permeable membrane (1 of 3) consist of lipid bags

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Sampling w/SPMDs

(continued)

- Obtain from Environmental Sampling Technologies (EST Labs), St. Joseph, MO
  - http://www.est-lab.com
- Service Provided by EST
  - Purchase (3) 1 mL Triolein SPMDs
  - Post deployment clean-up and extraction (placed in ampoule)
- Extract sent to analytical lab (1668A)
- Results converted to water conc.

Sampling w/SPMDs
(continued)

- Advantages
  - Integrates bioavail. PCBs over exposure period
- Disadvantages
  - Dissolved PCB Fraction (excludes particulate)
  - Minimum water depth requirements
  - Not for use in storm dominated outfalls (CSOs, MS4s)
  - Estimated water concentration (tPCB)
  - Expense

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PCB Analytical Method

- EPA Method 1668, Revision A
  - High Res GC/ High Res MS
  - Reporting Level (8-11 pg/L) on a congener basis (0.000011 µg/L)
  - Analyzes 209 Congeners
- In use
  - Potomac and Roanoke/Staunton River TMDLs

VA WQS of 0.0017 µg/L tPCB

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QA/QC

- Qualified Laboratories – ability to perform method
- Adhere to 1668A QC requirements
  - Method Blanks
  - Spike Recoveries (^{13}C labeled Congeners)
  - IPR/OPR (Initial/On-going Performance & Recovery)
- Rinsate Blanks (for 24h composite samples)

Projected Costs

- Laboratories (list will be available)
- Sample Collection (24h composites)
  - Clean technique (cost ?)
- Method 1668A Cost
  - $700 – $1,200 per sample
  - Greater number of samples < $$
- SPMD (estimated)
  - $450-$500 per SPMD
    - Includes clean-up and extraction
  - Plus Cost of Analysis

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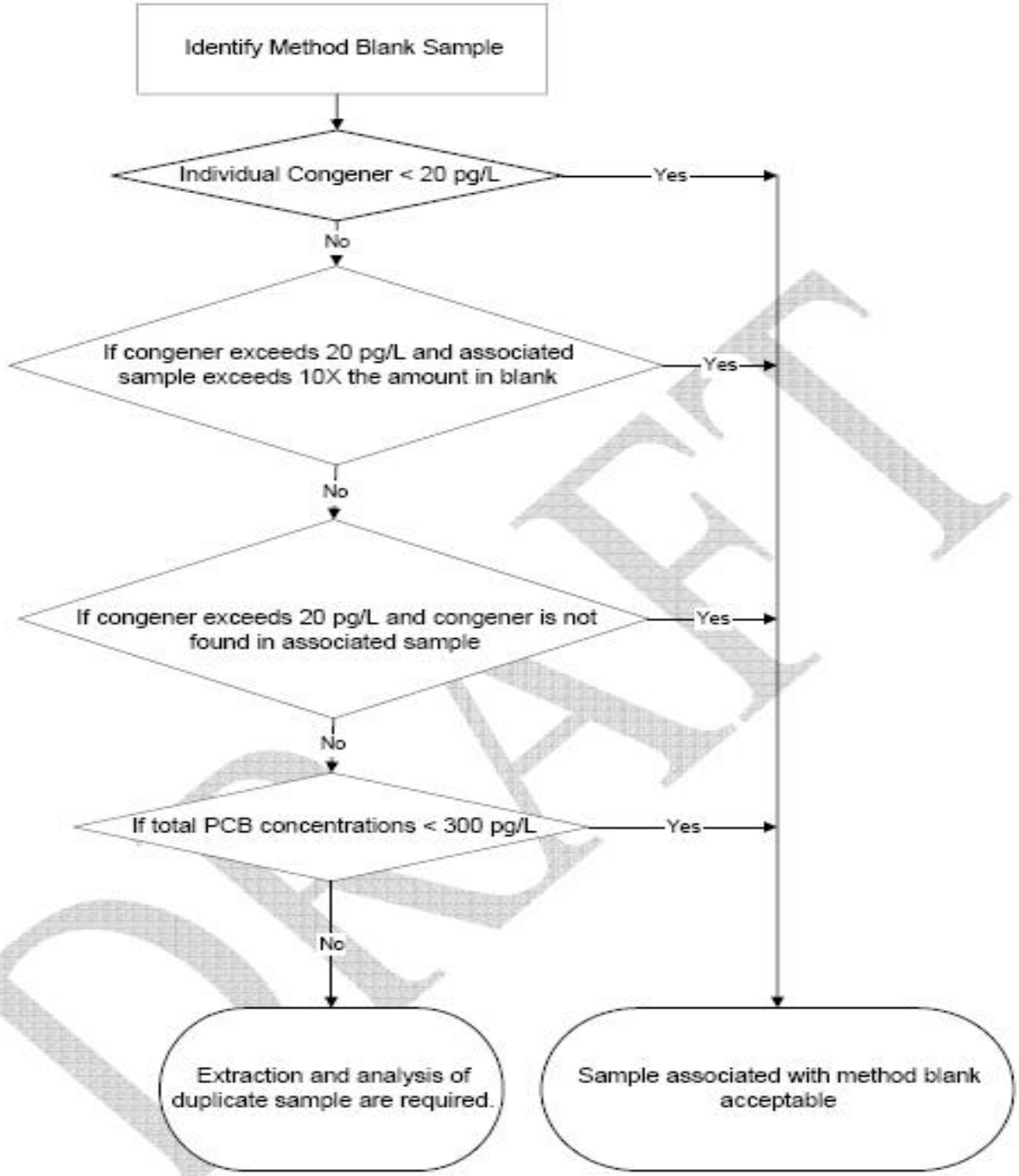
Additional Parameters

- TOC, POC, DOC, TSS
- Important relative to environmental fate of PCBs
  - Used for TMDL Model
- Collection recommended concurrent with PCBs
- Analyze using an approved method

Data Acceptability & Interpretation

- Meet method QC requirements
- Large number of PCB compounds (209) comprise tPCB
  - look at individually and as a summed total
- Decision Rules developed by DRBC
- Alternate approach used for the Potomac TMDL

DRBC Decision Rules

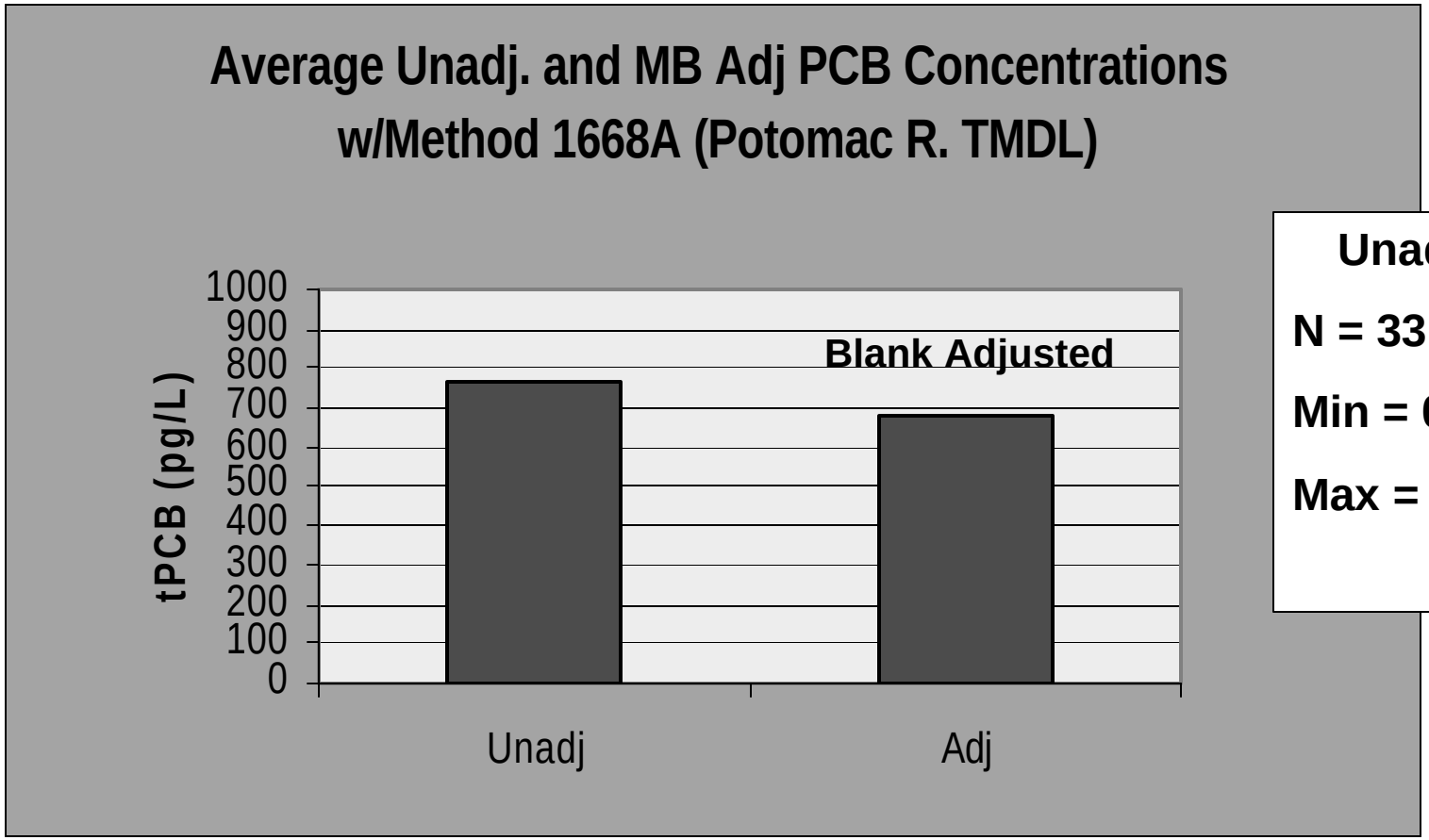


G. Cavallo, et al, Data Management in Support of TMDL Efforts

Data Interpretation - Alternate Approach

- Statistical based approach
- Utilized for the Potomac River Point Source PCB data
- Consisted of blank correcting data
  - Eliminated background contribution

Effluent Results - Potomac River Pt. Sources (TMDL)



Unadj. Conc.

N = 33

Min = 0 pg/L

Max = 4,749 pg/L

Includes PCB data from VA, MD and D.C.

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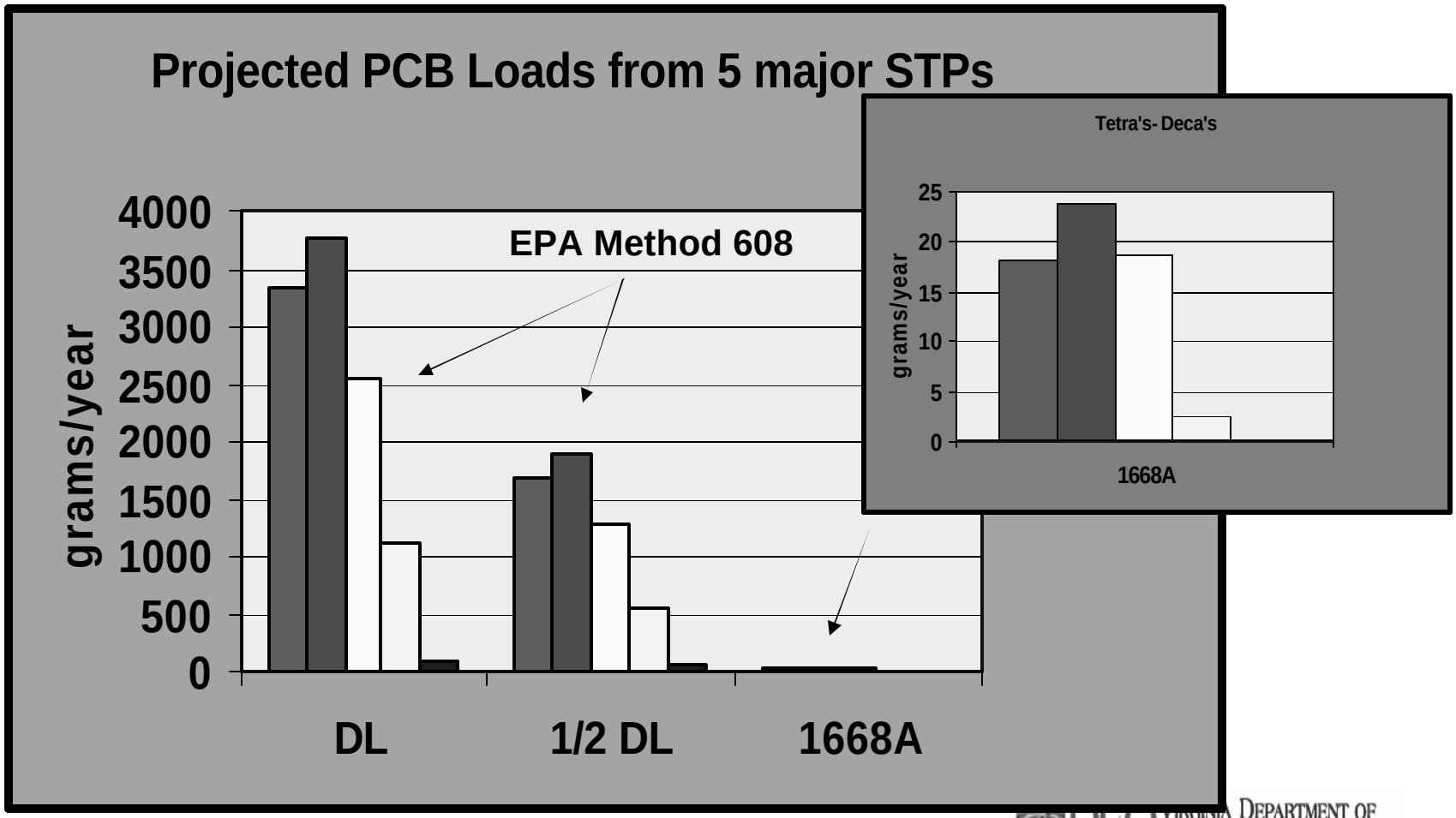
tPCB Results
- 1668A Compared w/SPMD -

- Data from single facility
- Method 1668A Results
  - Blank Adj. tPCB = 431 pg/L (ave.)
  - (n) = 6; combined grabs & composites
- Semi-permeable membrane device (SPMD)
  - tPCB = 391 pg/L

Conclusion

- PCB WLAs are required
- PCB data generated with this approach preferred
- TAC
  - Review methods and processes
  - Advise on technical issues

No PCB Data = Assumptions



QUESTIONS?

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Extra Slides

Method Blanks –Potomac R. Approach

- Eliminated background contamination
  - 95% false positives
- Statistical approach (Cited in method 1668A)
  - MB data set ($n \geq 10$)
- Mean +(2 Std. dev.) calc. for ea. congener
- Effluent adjusted **only** if MB contam. present in associated blank

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